

IN THE CLAIMS

1. (currently amended): An inspection method for cream solder for determining whether or not the shape of the cream solder applied on a printed circuit board is appropriate based on information about a side inclined portion of the cream solder, the method comprising

irradiating the cream solder ~~alternately~~ with light alternately from at least two illumination directions opposing each other in a single plane extending substantially parallel to the printed circuit board in close proximity thereto, said irradiated light hitting the cream solder, each of the illumination directions being substantially perpendicular to a viewing direction;

obtaining images along the viewing direction, the images being corresponding to respective irradiations in the illumination directions; and

obtaining a difference between the obtained images.

2. (currently amended): An inspection method for the cream solder according to claim 1, wherein the steps of obtaining at least two images, further comprising bright/dark images, and obtaining a difference further ~~comprise~~ comprising

taking pictures of a reflection light from the cream solder with a camera disposed above,

obtaining a difference between at least two of the bright/dark images so as to determine the inclination of ~~an~~ the side inclined portion of the cream solder from a luminance of the inclined portion, and

comparing a value of the luminance of the side inclined portion with a reference value set up preliminarily for determining whether or not the shape of the cream solder is appropriate.

3. (currently amended): An inspection method for the cream solder according to claim 1, wherein the solder is shaped generally as ~~[[a]]~~ truncated cones or generally as ~~[[a]]~~ truncated pyramids and is printed on a substrate, and wherein the method comprises

photographing the solder with a camera disposed above the substrate,
calculating information about areas of a top face and a bottom face of the solder from an image of the photographed solder and
computing an amount of the solder from the areas by an arithmetic operation.

4. (currently amended): An inspection method for the cream solder according to claim 1, further including

~~wherein the cream solder is on a circuit board and wherein the step of irradiating the cream solder with light from two directions comprises irradiating alternately from the two directions through a lighting means so as to obtain at least two images,~~

calculating a difference between the obtained images to gain information about a the side inclined portion of the cream solder and then

determining whether or not a shape of the cream solder is appropriate,
photographing with a camera light reflected from a non-soldered portion of the printed circuit board to obtain at least two images and then

obtaining a difference between at least two bright/dark images to remove the non-soldered portion from the difference between the obtained two images.

5. (currently amended): An inspection method for cream solder wherein the solder applied on a printed circuit board is shaped generally as ~~[[a]]~~ truncated cones or generally as ~~[[a]]~~ truncated pyramids, comprising steps of

irradiating light onto ~~the cream solder~~ each cone or pyramid alternately from at least two illumination directions opposing each other ~~alternately~~ in a single plane extending substantially parallel to the printed circuit board in close proximity thereto, through a lighting means, said irradiated light hitting the cream solder so as to obtain at least two images, each of the illumination directions being substantially perpendicular to a viewing direction;

calculating a difference between the two images to gain information about a side inclined portion of the cream solder and then

determining whether or not the shape of the cream solder is appropriate based on the information about the side inclined portion.

6. (currently amended): An inspection method for the cream solder according to claim 5 wherein ~~the solder is formed on a circuit board and~~

a reflection light from a non-soldered portion of the printed circuit board is photographed with a camera and then a difference between at least two bright/dark images is obtained to remove the non-soldered portion from the image.

7. (currently amended): An inspection apparatus for a cream solder on a printed circuit board, the apparatus comprising:

a camera disposed above the printed circuit board which is subject to inspection;

a lighting means disposed to irradiate substantially in a lateral direction relative to the cream solder applied to the printed circuit board and for irradiating light onto the cream solder

alternately in two directions opposing each other ~~alternately~~, in a single plane extending substantially parallel to the printed circuit board in close proximity thereto;

an arithmetic operating portion which obtains a difference of luminance between at least two images of a side inclined portion of the cream solder photographed with said camera by alternately turning on the lighting means; and

a determining portion for deciding whether or not the shape of the cream solder is appropriate by comparing a luminance of a the side inclined portion of the solder obtained by the arithmetic operating portion with a preliminarily set reference value.

8. (currently amended): An inspection apparatus for a cream solder on a printed circuit board, the apparatus comprising:

a camera disposed above the printed circuit board which is subject to inspection;

a lighting means disposed to irradiate substantially in a lateral direction relative to the cream solder applied to the printed circuit board and for irradiating light onto the cream solder alternately in two directions opposing each other ~~alternately~~ in a single plane extending substantially parallel to the printed circuit board in close proximity thereto;

image processing means for determining dimensions and area of the solder from an image of the solder taken with the camera ;

arithmetic operating means for computing an amount of solder from the dimensions and area determined by the image processing mean; and

control means provided with a program for inspecting a shape of the solder to control the apparatus.

9. (currently amended): An inspection apparatus for a cream solder on a printed circuit board, the apparatus comprising:

a camera disposed above the printed circuit board which is subject to inspection;

a lighting means disposed to irradiate substantially in a lateral direction of a non-soldered portion formed on the printed circuit board and for irradiating light onto the non-soldered portion alternately in two directions opposing each other alternately in a single plane extending substantially parallel to the printed circuit board in close proximity thereto; and

an arithmetic operating portion which switches the lighting means to obtain a difference between at least two images taken with the camera and removes the non-soldered portion from the image.

10. (previously presented): The inspection method according to claim 1, wherein the step of irradiating the cream solder alternately with light from at least two illumination directions opposing each other further comprises illuminating from lights deployed in line-shapes or illuminating from segments of lights deployed in a ring-shape.

11. (previously presented): The inspection method according to claim 10, wherein the segments of lights deployed in a ring-shape comprise four segments in an LED ring.

12. (previously presented): The inspection method according to claim 1, wherein the cream solder is printed on a substrate, and wherein each of the illumination directions is a direction from 5-10 mm elevation above the substrate.

13. (currently amended): The inspection method according to claim 1, wherein the cream solder is shaped generally as [[a]] truncated cones or generally as [[a]] truncated pyramids including the side inclined portion.

14. (previously presented): The inspection method according to claim 5, wherein the step of irradiating the cream solder alternately with light from at least two illumination directions opposing each other further comprises illuminating from lights deployed in line-shapes or illuminating from segments of lights deployed in a ring-shape.

15. (previously presented): The inspection method according to claim 14, wherein the segments of lights deployed in a ring-shape comprise four segments in an LED ring.

16. (previously presented): The inspection method according to claim 5, wherein the cream solder is printed on a substrate, and wherein each of the illumination directions is a direction from 5-10 mm elevation above the substrate.

17. (previously presented): The apparatus according to claim 7, wherein the lighting means further comprises lights deployed in line-shapes or segments of lights deployed in a ring-shape.

18. (previously presented): The apparatus according to claim 17, wherein the segments of lights deployed in a ring-shape comprise four segments in an LED ring.

19. (previously presented): The apparatus according to claim 7, wherein each of the two directions is a direction from 5-10 mm elevation above the printed circuit board.

20. (previously presented): The apparatus according to claim 8, wherein the lighting means further comprises lights deployed in line-shapes or segments of lights deployed in a ring-shape.

21. (previously presented): The apparatus according to claim 20, wherein the segments of lights deployed in a ring-shape comprise four segments in an LED ring.

22. (previously presented): The apparatus according to claim 8, wherein each of the two directions is a direction from 5-10 mm elevation above the printed circuit board.

23. (previously presented): The apparatus according to claim 8, wherein the cream solder is shaped generally as a truncated cone or generally as a truncated pyramid including the side inclined portion.

24. (previously presented): The apparatus according to claim 9, wherein the lighting means further comprises lights deployed in line-shapes or segments of lights deployed in a ring-shape.

25. (previously presented): The apparatus according to claim 24, wherein the segments of lights deployed in a ring-shape comprise four segments in an LED ring.

26. (previously presented): The apparatus according to claim 9, wherein each of the two directions is a direction from 5-10 mm elevation above the printed circuit board.